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ABSTRACT

Local teachers and other school personnel in Hawaii expressed a need for operational guidelines to use in deciding whether or not to refer students for diagnostic evaluations for specific learning disabilities (SLD). This project was designed to evaluate whether the Windward Rating Scale (WRS), a locally-developed teacher rating scale of student behavior, could be used as a screening tool in the referral process. Teacher ratings of 720 SLD-certified and non-special education students in grades K-6 were obtained and analyzed. Psychometric properties and diagnostic efficiency of the WRS were examined. The WRS was able to accurately classify 78 percent of the students in a discriminant classification analysis, with 83 percent accuracy obtained using selected cutoff scores. Implications of the evaluation results for both theoretical and applied issues are discussed. (Author)

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DISCRIMINANT VALIDITY OF A TEACHER-DEVELOPED RATING SCALE FOR SPECIFIC LEARNING DISABILITIES

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Abstract

Local teachers and other school personnel in Hawaii expressed a need for operational guidelines to use in deciding whether or not to refer students for diagnostic evaluations for learning disabilities. This project was designed to evaluate whether the Windward Rating Scale (WRS), a locally-developed teacher rating scale of student behavior, could be used as a screening tool in the referral process. Teacher ratings of 720 SLD-certified and non-special ed students in grades K-6 were obtained and analyzed. Psychometric properties and diagnostic efficiency of the WRS were examined. The WRS was able to accurately classify 78% of the students in a discriminant classification analysis, with 83% accuracy obtained using selected cutoff scores. Implications of the evaluation results for both theoretical and applied issues are discussed.

DISCRIMINANT VALIDITY OF A TEACHER-DEVELOPED RATING SCALE FOR SPECIFIC LEARNING DISABILITIES

The identification of children with learning disabilities continues to be a difficult problem both among researchers and educators (Harber, 1981; Ysseldyke, Algozzine, Richey, and Graden, 1983). The definition of what comprises a learning disability is itself controversial and unsettled, and it is becoming more frequently argued that the learning disabilities are, in fact, a heterogeneous group of disorders (Hammil, Leigh, McNutt, and Larsen, 1981; Harris, 1982; Olson and Mealor, 1981). Although a national definition of learning disabilities does exist (USOE, 1977), both researchers and practitioners often fail to agree on how to identify the learning disabled (LD) population (Olson and Mealor, 1981). Shepard and Smith (1983) report that although local school districts in Colorado deviate little from the state definition of and suggested criteria for identifying LD, special education units throughout the state vary in the proportion of their enrollments identified as LD, from 2.11% to 8.56% in 1979-80. In Hawaii, according to District Superintendent Kengo Takata (1982) percentages of the total enrollment which were certified as having specific learning disabilities (SLD) for the 1981-82 academic year varied between districts from 3% to 10%. These statistics suggest that there may be some variation in the identification of the learning disabled even within departments of education. Clearly, the accurate and reliable identification of LD children is of major concern, particularly if we believe that intervention programs targetted for these children are effective in helping them.

The process of identifying SLD children in most school districts includes the stages of referral, assessment, staffing, and placement. Difficulties with identification occur at all stages of this process. The current research project was initiated in response to concerns with the referral stage of the identification process.

The person most likely to refer a child for special help or assessment in school is the classroom teacher. In Colorado, 76% percent of identified LD cases originated with teacher referrals. Only 8% were referred by parents (Shepard and Smith, 1983). In the Windward Oahu District of the Hawaii DOE, most referrals also come from classroom teachers. These teachers, in addition to school counselors and principals, have expressed concern with the process of identifying children with specific learning disabilities. They have been particularly concerned over the lack of clear operational guidelines to aid them in making appropriate referrals of students for diagnostic evaluations. Apparently with increasing frequency, the students they were referring for evaluation were not being certified SLD by diagnostic teams. School personnel considered the process of inappropriately referring a student who was eventually found not to be eligible for special services a costly misuse of their time and energy, as well as a misuse of special services resources. In fact, Shepard and Smith (1983) have estimated that in Colorado the cost per student for an evaluation and staffing by a diagnostic team exceeds 500 dollars, not including the cost of the referring personnel. In light of the acknowledged vagueness of the definition of LD, the controversy about operationalizing the national definition and suggested criteria for

identifying LD, and the recognized cost of evaluating a student for SLD, the concerns of the school personnel seemed well justified. Hence, a way was sought by the Superintendent of the Windward Distict to address these concerns and, at the same time, to improve the efficiency of the referral stage of the identification process.

One potential solution to the problem was proposed which incorporated an instrument already intrinsic to the referral process. In the Windward District, referring teachers are asked to complete a 65-item rating scale (the Windward Rating Scale) on each student referred for diagnostic evaluation. The rating scale helps teachers structure their observations of students, provides a fairly comprehensive survey of student abilities and behaviors, and provides the diagnostic team with a wealth of data about the student from an observer who spends more waking hours with a child than even the child's parents. The rating scale has been primarily used by diagnostic teams to supplement other information obtained from the school about the student (i.e., achievement test scores, classroom performance, and identified areas of concern). However, no effort has been made to evaluate the feasibility of having teachers use the rating scale as a tool to guide their referral decisions, nor have the psychometric properties of the scale been evaluated. It was proposed that the Windward Rating Scale (WRS) be evaluated for its usefulness as a possible formal screening instrument to guide school personnel in making their referral decisions. The current project was designed to provide this evaluation.

Specifically, the applied aims of this project were the following:

1. To determine whether the WRS can be used as an efficient screening tool for SLD;
2. To determine how successfully the WRS discriminates between SLD and "normal" children, and to improve its discriminability, if possible;
3. To refine the WRS so that it provides effective screening without requiring inordinate time to complete;
4. To formulate a guideline to assist teachers in using the WRS to screen referrals for special services assessment.

Further, the following questions were addressed:

1. What is the factor composition of the WRS? Is the current organization of items an accurate reflection of its underlying structure?
2. What factors, besides SLD status, contribute to the variance in WRS scores?

METHOD

Instrument

The Windward Rating Scale (WRS) is a student rating scale constructed by Special Services Diagnostic-Prescriptive teachers in the Windward Oahu District of the Hawaii DOE. It consists of 65 items organized into three substantive areas, personal/social/behavioral characteristics, perceptual/motor orientation, and academic ability. Elementary teachers are asked to rate individual students on each item on

a four point scale, where a rating of "1" indicates "You have not noticed this behavior at all," a "2" indicates "You have noticed the behavior to a slight degree," a "3" indicates "You have noticed the behavior to a considerable degree," and a "4" indicates "You have noticed the behavior to an uncomfortable degree." Supplemental information provided by each teacher for each student rated are birthdate, age, sex, school, teacher doing the rating, and (for the purposes of this study only) student's ethnicity.

Interrater Agreement

Subjects and Procedure

Special education and regular education teachers in five schools selected by the district school psychologist as representative of district elementary schools were asked to participate in a study of interrater agreement involving the WRS. Participating teachers were asked to select 10 students who were certified as having a specific learning disability. Each student selected was then rated on the WRS twice, once by a regular education teacher who knew the child well and once by the student's special education teacher. The teachers performed these ratings independently.

Fourteen special education teachers and 44 regular education teachers rated fifty 5-12 year old students (M=9.2, SD=1.93). Eighteen girls (36%) and 32 boys (64%) were rated. These students represented a number of ethnic groups including Black (6%), Caucasian (14%), Chinese (2%), Filipino (4%), Hawaiian (2%), part-Hawaiian (56%), Japanese (2%), Korean (2%), Portuguese (6%), Puerto Rican (2%), and Samoan (2%).

Interrater agreement was calculated as the percentage of agreements compared to the sum total of agreements plus disagreements. For the purposes of calculating agreement, ratings of 1 or 2 and of 3 or 4 were considered equivalent. Hence, if a student received a rating of "1" from one teacher and of "2" from the second, the ratings were considered to be in agreement.

Evaluation Study

Subjects

The records of five hundred sixty-four K-6 grade students from Windward Oahu District elementary schools who had been evaluated by Special Services diagnostic teams during the 1981-1982 academic year were selected for inclusion in this phase of the evaluation. The records were randomly chosen from the population of all Windward Oahu special education elementary students in the 1981-82 academic year, as well as students who had been evaluated and found not to be eligible for special education. This sample was stratified by grades to correspond to the proportion of students in each grade composing the Windward District special education population.

After the initial sample was obtained, a decision was made to include only those students receiving special education who were certified as having specific learning disabilities (SLD). The students in the sample certified as mentally retarded, hearing impaired, visually impaired, orthopedically handicapped, emotionally handicapped, and speech impaired whose teachers had completed Windward Rating Scales (a total of 48 cases in the sample) were excluded from the analyses.

Demographic information and the WRS ratings of 437 students certified as having specific learning disabilities and of 79 students who were referred for evaluation but not certified were extracted from their records (see Appendix A for a description of the criteria by which students are certified SLD in the Hawaii Department of Education). In addition, to obtain a "normal" comparison group, teachers were asked to complete WRS's on students who were not certified, had not been referred for evaluation, and were not receiving special education. The sample of students upon whom this phase of the study was based was composed of 437 SLD (61%), 79 non-SLD referred (11%), and 204 non-SLD, nonreferred (28%) elementary students. The latter two groups were combined into a single, non-special ed group of 283 (39%) students to be compared with the criterion group of 437 SLD students. The total sample size was 720.

Over 400 teachers from 25 schools performed the ratings. The ages of students rated ranged from 3 (2%) through 13 (1%) years old (M=8.5, SD=2.0). Girls comprised 37 percent of the sample (N=266) and boys the remaining 63 percent (N=454). Fourteen ethnic groups were represented in the sample of students (see Table 1 for a summary of subject characteristics).

Insert Table 1 about here

Procedure

Data Analysis. As a first step towards refining the WRS, the means and standard deviations of each of its 65 items were examined and those items with standard deviations below .70 were discarded. It was felt that if items showed low variance in a large sample so diverse in age, sex, ethnicity, and raters, such items would not discriminate well between groups and would not contribute positively to the screening properties of the instrument.

The data obtained from teacher ratings of the 720 students in the sample on the remaining items were subjected to a factor analysis to examine the component factor structure of the WRS. Product-moment correlation coefficients were computed, and a principal components analysis with iterations was performed on the resulting correlation matrix.

The analysis yielded seven components with eigenvalues greater than 1.00. A principal axis factor analysis with promax rotation was performed in which items were forced into seven factors. Based on the results of the factor analysis, total scores for each of the seven factors derived from the factor analysis were calculated for each student. These total factor scores were obtained by adding together the unweighted scores of those individual items which loaded most heavily on each particular factor.

In order to examine how well WRS scores discriminate learning disabled from non-learning disabled students, a discriminant classification procedure was performed. The total sample was randomly divided into two subgroups, care being taken that all schools were represented in each subgroup. The mean age of students in subgroup 1 was 8.6 years (SD=1.8) and of students in subgroup 2 was 8.4 years (SD=2.2) (see Table 2).

Table 1

Demographic Information for 720

K-6 Grade Students Rated on the

Windward Rating Scale

Variable	SLD (n=437)	Non-SLD (n=283)
Sex (%)		
Male	68	56
Female	32	44
Age		
Mean	8.09	9.22
SD	1.85	2.09
Ethnicity (%)		
Native American	.23	0
Black American	3.20	1.34
Chinese	1.14	3.01
Filipino	6.18	5.02
Hawaiian	5.03	3.01
Part-Hawaiian	38.90	37.46
Japanese	3.43	9.03
Korean	.92	1.67
Portuguese	4.35	5.69
Puerto Rican	2.06	2.01
Samoan	7.32	2.01
Caucasian	20.59	21.40
Other	6.41	8.35

Insert Table 2 about here

The discriminant classification was performed on one subgroup and tested on the second, with special ed certification status as the criterion.

A canonical discriminant analysis was then performed using the total factor scores of the total sample. The discriminant coefficients derived from this analysis were used, in turn, to weight the students' total factor scores. The linear combination of these total factor scores resulted in a total score on the WRS for each student. These total scores were analyzed to determine a cutoff score which would yield reasonably accurate classification of SLD and non-SLD students. The cutoff score would serve as a guideline which teachers and other school personnel could use to guide their referral decisions.

The cutoff score was selected such that students with total weighted WRS scores greater than the cutoff would probably be referred for further evaluation; whereas, students with total weighted WRS scores less than or equal to the cutoff would be less likely to be referred for further diagnostic evaluation. Potential cutoff scores were evaluated with two goals in mind: (1) to reasonably minimize diagnostic error, and (2) to reasonably minimize false negative errors.

Meehl and Rosen (1955) argue, and Finn (1982) reiterates, that in order to minimize diagnostic error in a population, the selection of an optimal decision rule to diagnose membership or nonmembership in a category requires consideration not only of the amount, but also the type of diagnostic error. In addition to minimizing diagnostic errors generally, cutoff scores were examined with the aim of reasonably minimizing false negative errors, specifically. This goal seemed justified given the potential consequences of using the cutoff score as a guide to referring or not referring students for further evaluation. It was reasoned that non-SLD students wrongly referred for evaluation (false positive errors) would be correctly classified in the more extensive evaluations performed by the specialized diagnostic teams. However, SLD students who were mistakenly not identified and not referred (false negative errors) would not be further evaluated and might go as long as a year before being considered for further evaluation. In the interim, such a student and his or her teacher would experience a year of struggling, frustration, and possible failure. For these reasons, a false negative error might be considered more costly than a false positive error, in the currency of human suffering and lost potential.

Multiple regression analyses and post hoc comparisons of group means were performed. In these analyses, each factor score served as a dependent variable. The classification and demographic variables special ed group assignment, sex, age, and ethnicity served as independent variables.

RESULTS

Interrater Agreement

Interrater agreement on individual WRS items ranged from .40 to 1.00.

Table 2

Demographic Information for Two

Subgroups of 720 K-6 Grade Students

Rated on the Windward Rating Scale

Variable	Subgroup 1 (n=349)	Subgroup 2 (n=371)
SLD (%)		
Yes	61.6	59.8
No	38.4	40.2
Sex (%)		
Male	65.0	61.0
Female	35.0	39.0
Age		
Mean	8.4	8.6
SD	2.2	1.8
Ethnicity		
Native American	0	.4
Black American	1.4	3.6
Chinese	1.4	2.5
Filipino	6.5	5.0
Hawaiian	4.8	3.6
Part-Hawaiian	36.5	40.4
Japanese	7.9	3.9
Korean	.8	1.4
Portuguese	5.9	3.3
Puerto Rican	2.8	1.4
Samoan	3.7	6.4
Caucasian	21.5	20.6
Other	6.8	7.5

Total interrater agreement was .76. Although a minimum interrater agreement index of .80 is usually necessary for a measure to be considered acceptable in behavioral research, the agreement achieved in this study is comparable to that found in similar research (Quay, 1979). The relatively low agreement does suggest that, in specific areas of student behavior, teachers rate the same students differently. This difference in ratings may be due to a number of factors, including differences in teachers' tolerance or their norms of acceptability for that behavior, students behaving differently with different teachers, or some combination of these factors.

Because in the evaluation sample regular ed teachers rated the normal comparison students while special ed teachers, for the most part, rated SLD students, it was important that a systematic bias in rating students not exist between special and regular ed teachers. Such a bias would present a methodological confound and would compromise any statements about the ability of the WRS to discriminate between normal and SLD students independent of which teacher did the actual rating. A comparison of means between special ed and regular ed teachers' ratings revealed that special ed teachers' mean ratings were higher on 29 items, while regular ed teachers' mean ratings were higher on 21 items. Table 3 shows the results of a statistical analysis of the differences between regular

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Insert Table 3 about here

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and special ed teachers' ratings.

The analysis reveals either that the mean ratings of these groups did not differ significantly.

Hence, this analysis of the interrater agreement data reveals that although interrater agreement is relatively low, no systematic differences existed between the ratings of special and regular ed teachers. Hence, any conclusions about the discriminative power of the WRS are not undermined by the presence of a systematic ratings bias.

Evaluation of the WRS

Factor Analysis

Eleven of the 65 WRS items were discarded with standard deviations less than .70 (see Table 4). The remaining 54 items were subjected to a

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Insert Table 4 about here

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principal components analysis. Seven factors emerged with eigenvalues greater than 1.00. The data was re-analyzed using a promax rotation of a principal axis factor analysis with the number of factors set to seven. Table 5 lists the items and their loadings on each of the seven factors. The configuration of item factor loadings suggests the presence of a personal-social conduct factor (factor 1), an academic performance factor (factor

Table 3

Comparisons Between Special Ed and Regular Ed Teacher Ratings of Students in Interater Agreement Sample (N = 50)

Type of Score	Reg. Ed		Spec. Ed		Diff.	t	p
	$\bar{m}$	SD	$\bar{m}$	SD			
Factor 1	26.3	10.0	26.8	8.5	- .50	-.44	NS
Factor 2	29.6	10.4	31.0	7.2	-1.4	-.91	NS
Factor 3	13.3	6.1	14.0	3.7	- .70	-.92	NS
Factor 4	10.3	4.6	10.1	3.7	.30	.44	NS
Factor 5	2.9	1.2	2.6	.90	.30	1.61	NS
Factor 6	1.8	.90	1.9	1.1	- .10	-.48	NS
Factor 7	4.6	1.9	4.0	1.4	.60	1.7	> .09

Table 4

Items Eliminated Due to Low Standard Deviations

Item	M	SD
Inappropriate, excessive affection displays	1.20	.56
Excessive need to touch, cling, hold another	1.30	.67
Excessively meticulous, exacting, pendantic	1.23	.57
Excessive drooling	1.04	.27
Thumb sucking, head banging	1.09	.44
Cries easily and often	1.25	.59
Destructive of others' work	1.26	.65
Gets lost in familiar surroundings	1.12	.42
Frequent tremulous or rigid hand movements	1.16	.50
Frequent mild visual impairments	1.25	.61
Frequent mild hearing impairments	1.30	.67

2), a perceptual-motor performance factor (factor 3), a verbal expression factor (factor 4), an anxiety-withdrawal factor (factor 5), a cyclicity factor (factor 6), and a social relationship factor (factor 7).

The means and standard deviations of the seven factor scores are presented in Table 5. The SLD group obtained significantly higher ratings than the non-SLD group on all the scores.

Insert Table 5 about here

Discriminant Analysis

Results of a discriminant classification of students based on teachers' WRS ratings of them are summarized in Table 6. Results of the discriminant classification were similar for subsamples one and two, so subsample results were combined in Table 6.

Insert Table 6 about here

Classification based on factor scores resulted in 78% accurate classification and 22% classification errors. Classification errors consisted of 55 (8%) false positive identifications (i.e., non-SLD students classified as SLD) and 105 (14%) false negative errors (i.e., SLD students classified as non-SLD).

Analysis of cutoff scores and diagnostic efficiency

Discriminant canonical analysis were carried out on total factor scores for the entire sample. The canonical multiple correlation coefficient for the factor score analysis (R^2=.396, F=56.13, $p < .00001$) was significant. This measure indicates that WRS scores can account for close to 40% of the variance associated with criterion group differences.

Canonical coefficients derived from the analyses were used to weight and combine factor scores into a weighted total factor score. Based on the results of the discriminant canonical analysis, the linear combination of WRS factor scores which best discriminates between SLD and non-SLD groups is :

$$Y=-.027PS+.118ACAD-.020PM+.083VE-.046ANX-.066CY-.078SR$$

where PS is factor 1 (personal-social conduct), ACAD is factor 2 (academic performance), PM is factor 3 (perceptual-motor performance), VE is factor 4 (verbal expression), ANX is factor 5 (anxiety-withdrawal), CY is factor 6 (cyclicity), and SR is factor 7 (social relationships).

Utilizing this formula, y-scores were generated for subjects in the total sample. These y-scores were examined to determine a range of cutoff scores which could be tested for classification accuracy. Scores between 1.3 and 3.1 were examined to determine how accurately SLD students were identified if each score was used as a cutoff, with students having scores above the cutoff being referred and students having scores below the cutoff not being referred.

Table 5

Means and Standard Deviations of SLD-Certified and Non-Certified Students for Factor-Based WRS Scores

Factor	Group					
	SLD (N = 437)		Non - SLD (N = 283)			
	M	SD	M	SD	t (718)	p
1. Personal/social conduct	24.38	9.74	21.51	9.92	3.84	.0001
2. Academic performance	34.94	8.90	21.01	9.32	20.14	.0001
3. Perceptual motor performance	16.05	6.86	11.12	4.47	10.69	.0001
4. Verbal expression	11.36	4.36	6.86	3.00	15.17	.0001
5. Anxiety/withdrawal	3.02	1.35	2.52	1.10	5.18	.0001
6. Cyclicity	1.94	1.07	1.41	0.79	7.24	.0001
7. Social relationship	4.49	1.95	2.99	1.48	11.08	.0001

Table 6a
Promax Principle Axis Factor Analysis of the Windward Rating Scale

Item	Factor						
	1	2	3	4	5	6	7
Socially bold and aggressive	.88	.03	-.06	-.07	-.07	-.04	-.03
Cannot seem to control self	.85	.01	.10	-.06	-.10	-.02	.02
Impulsive, reckless, uninhibited	.82	-.13	.15	.09	.05	-.02	-.07
Overexcitable in normal play	.79	.00	-.03	.02	-.24	.17	.09
Hyperactive and restless	.77	.06	.08	-.02	-.22	.18	-.02
Negative and aggressive to authority	.76	-.02	-.09	.00	.34	-.12	-.08
Explosive and unpredictable behavior	.76	-.17	.02	.12	.13	.07	-.09
Attention-seeking, speaks out of turn	.76	.07	.01	-.10	-.05	-.02	.02
Stubborn, uncooperative behavior	.70	.12	-.10	.00	.35	-.07	-.03
Erratic, flighty, scattered behavior	.62	.13	.06	-.06	-.13	.26	.10
Behavior often inappropriate for circumstances, consequences not foreseen	.61	.09	.05	.02	.09	.10	.17
Shallow feeling for others	.60	-.04	-.03	.01	.31	-.07	.09
Low frustration tolerance	.56	.21	-.03	-.03	.09	.13	.02
Behavior goes in cycles	.52	-.09	-.07	.11	-.02	.44	.11
Confused by punishment	.31	-.06	.05	.13	.12	.17	.24
Upset by changes in routine	.28	.11	.03	.07	.24	.14	.20
Poor reading	-.04	.88	-.08	.16	-.03	-.17	-.08
Slow finishing work	-.10	.84	-.05	-.09	.14	.18	-.06
Impaired concentration and attention	.14	.79	-.04	-.13	.05	.16	.06
Poor long-term memory	.02	.77	.06	.11	-.08	-.19	.15

Table 6a, cont.

Item	Factor						
	1	2	3	4	5	6	7
Easily distracted	.25	.75	-.05	-.16	.02	.15	.06
Poor short-term memory	-.02	.69	.14	.07	-.05	-.13	.18
Confusion in spelling and writing	.00	.69	.20	.17	-.03	-.03	-.22
Poor math, confusion in number processes	-.09	.69	.06	.17	-.03	-.02	.04
Poor organization of work	.13	.66	.05	.08	.04	.15	-.03
Confused following directions	.03	.62	.07	.02	-.01	.06	.26
Confusion about instructions but success with verbal tasks	.02	.62	.01	.09	.01	.12	.02
Impaired ability to make decisions from many choices	.00	.43	.02	.16	.16	.12	.33
Always late or confused	-.13	.32	.28	-.09	.22	.15	.20
Impaired size discrimination	-.03	.10	.77	-.01	.04	-.07	.09
Poor gross motor coordination	-.02	-.00	.75	.00	.04	.17	-.05
Poor fine motor coordination	.07	.25	.75	-.06	.03	.06	-.26
Impaired tactile discrimination	.02	-.09	.72	.07	.03	-.01	.18
Distorted body image	.04	.00	.72	.08	.00	-.10	.06
Impaired discrimination of right-left, up-down	.02	.24	.69	-.03	-.08	-.11	.11
Generally clumsy or awkward	.03	-.10	.67	-.01	.08	.28	-.01
Poor printing, writing, drawing	.07	.47	.45	.11	.02	.06	-.30
Impaired auditory discrimination	-.10	.17	.32	.26	.01	-.03	.22
Gropes for words to express self	-.03	.14	-.02	.79	-.02	.13	.03
Unable to tell comprehensible story	.01	.24	.06	.67	-.03	-.00	.08

Table 6a, cont.

Item	Factor						
	1	2	3	4	5	6	7
Uses immature, poor vocabulary	.04	.35	-.07	.66	-.04	-.04	.02
Misunderstands words	-.05	.36	-.01	.60	-.04	-.03	.17
Mild speech irregularities	.01	-.12	.25	.47	.06	.12	-.06
Seems generally unhappy	.15	.06	.02	-.04	.66	.03	.02
Withdraws from group activities	-.14	.05	.13	.03	.54	.10	.09
Daydreaming alternates with hyperactivity	.22	.17	.05	.01	.08	.41	.07
Hourly, daily variability in performance	.22	.15	.05	.20	.12	.33	.01
Tires easily	.01	.16	.16	.01	.26	.30	.09
Difficulty reasoning things out logically with others	.18	.24	.02	.18	.16	-.02	.43
Confused, apprehensive about rightness of response, indecisive	-.04	.34	.03	.14	.12	.07	.40
Overly gullible and easily led by peers	.14	.17	.05	.13	-.13	.25	.35
Lacks a variety of responses	.17	.16	.05	.26	.05	.15	.31
% of variance*	13.28	17.17	12.74	10.22	5.46	5.48	7.54

*ignoring other factors

Table 6

Results of Discriminant Classification of SLD and Non-SLD Students Based on Windward Rating Scale Factor Scores

Results	Frequency	Percentage
Accurate Classification		
SLD	339	47%
Non-SLD	220	31%
Classification Errors		
False Positives	63	9%
False Negatives	98	14%
Totals	720	101%*

*Exceeds 100% due to rounding.

Classification results for selected cutoff scores for factor scores are summarized in Figures one and two. Figure one illustrates that the total number of errors tends to decrease, reach a minimum, and then increase as higher cutoff scores are selected. It may be argued, based on these results, that in order to

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Insert Figure 1 about here

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minimize the probability of making diagnostic errors, a relatively high cutoff score (e.g., 2.3) should be used.

Minimizing the probability of diagnostic error is not the only consideration, however, in choosing a cutoff. Rather, a decision must also be based on the kind of error associated with specific cutoffs and the cost of each of these kinds of errors. Figure 2 is a plot of false negative error probabilities and false positive error probabilities. This figure shows that higher cutoff scores are associated with higher probabilities of making false negative errors. On the other hand, higher cutoff scores result in consistently lower probabilities of making false positive errors. As mentioned above, false negative errors may be of

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Insert Figure 2 about here

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particular concern as an SLD student misidentified as being non-SLD may not be re-evaluated for some time with potentially unfortunate consequences.

Multiple regression

Results of the regression analyses are presented in Table 7. Seven analyses were performed, one for each of the factor scores. In each analysis, independent variables were group (SLD or non-SLD), sex, ethnicity, age (treated as a categorical variable), and the interactions of special ed status with each of the demographic variables. Because no *a priori* model was proposed for the effects of the independent variables on

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Insert Table 7 about here

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the dependent variable, each effect was treated as if it had been entered last in the model (i.e., effects of all other variables were partialled out).

The multiple correlation coefficients were significant for each of the seven dependent variables. Sex and age were the only significant effects in the regression analysis of factor 1 scores (personal-social conduct). Group membership was not a significant effect ($F=3.39$, $p > .05$). Post hoc comparisons of means using Tukey's HSD revealed that the sex effect was due to boys having a significantly higher mean score than girls. The age effect consisted of five and six year olds having significantly higher mean scores while 11 and 12 year olds obtained significantly lower mean

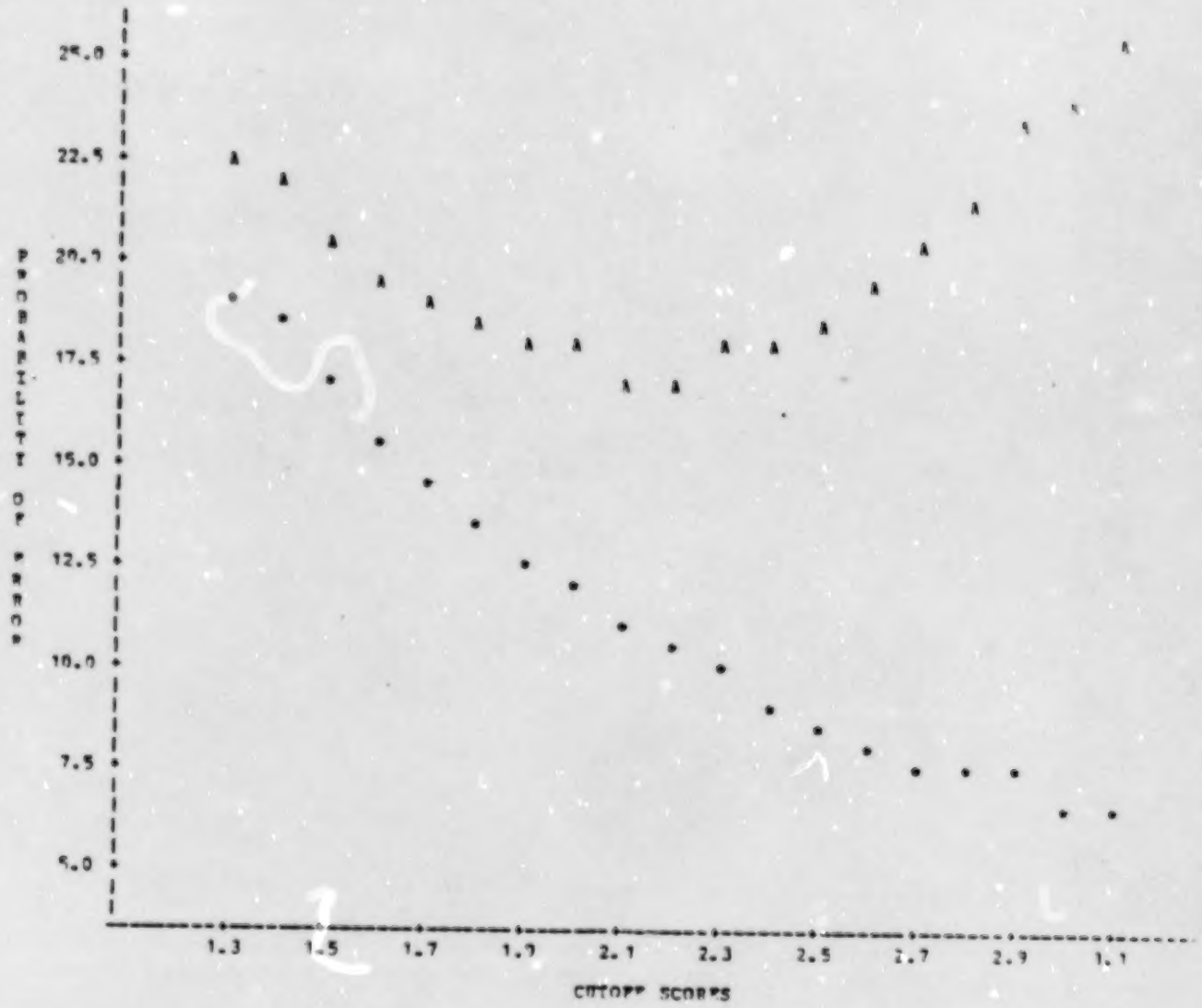

Figure 1

Cutoff Scores: Weighted* vs. Unweighted Total Errors

*Weighted by the base rate of occurrence and nonoccurrence of SLD in the elementary school population of the Windward Oahu District.

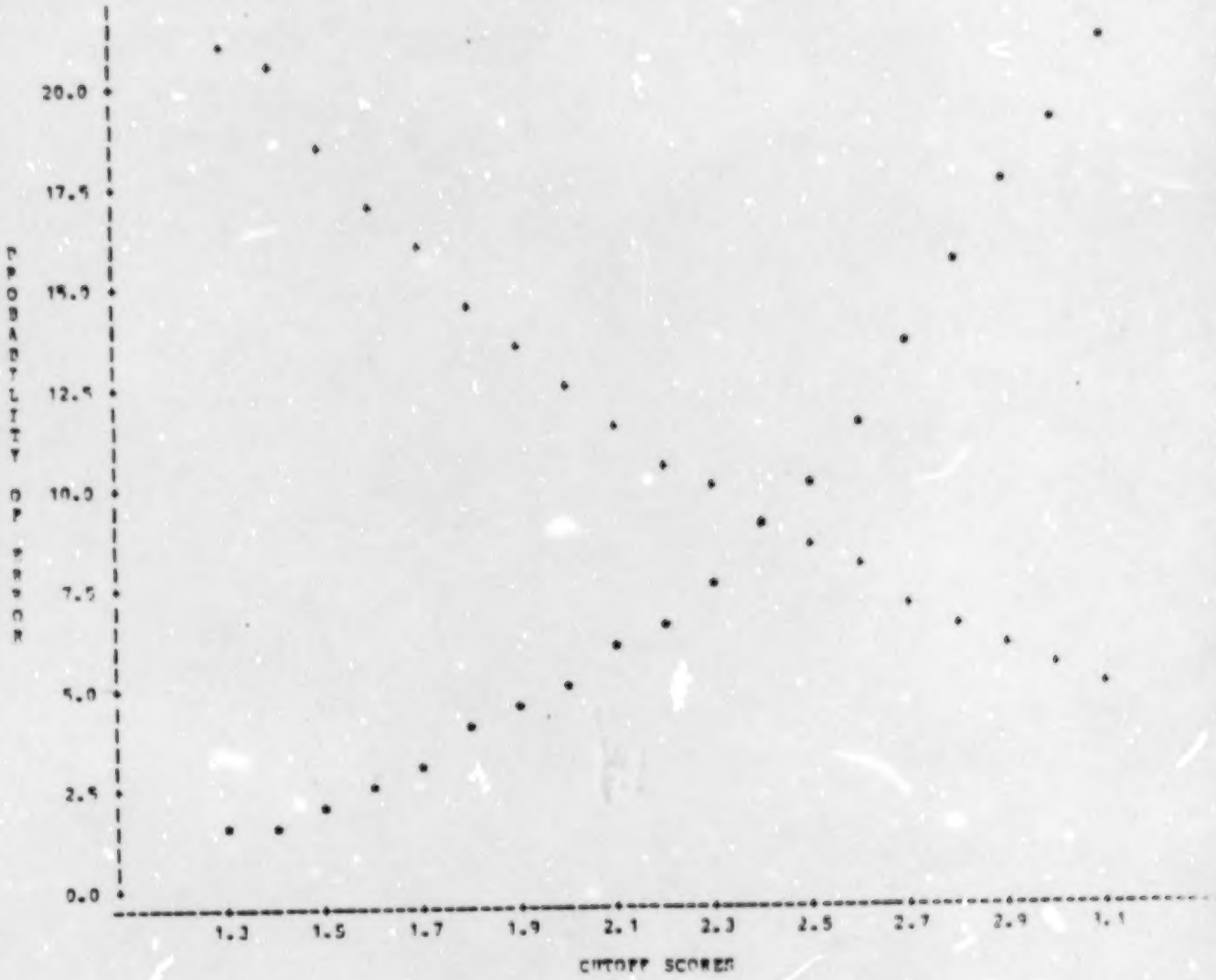

Figure 2

Cutoff Scores: False Positive vs. False Negative Errors

Table 7

Results of Regression Analyses for Total Factor Scores

Dependent variable	R^2	Source	df	F	p
Factor 1	.166		46	2.88	.0001
		age	10	3.42	.0002
		sex	1	33.48	.0001
Factor 2	.453		46	11.97	.0001
		group	1	56.82	.0001
		age	10	3.46	.0002
		sex	1	5.30	.02
		group x sex	1	6.52	.01
		group x ethnicity	11	1.95	.03
Factor 3	.333		46	7.23	.0001
		group	1	15.74	.0001
		age	10	10.07	.0001
		group x ethnicity	11	2.10	.018
Factor 4	.346		46	7.67	.0001
		group	1	23.59	.0001
		age	10	4.14	.0001
Factor 5	.119		46	1.95	.0003
		group x sex	1	5.70	.017
Factor 6	.146		46	2.48	.0001
		group	1	9.35	.002
Factor 7	.243		46	4.65	.0001
		group	1	4.57	.033
		age	10	2.98	.001
		sex	1	4.53	.034

Note: Only those sources of variance out of the seven sources entered into the regression model significant at the .05 level are listed in the table.

scores compared to other age groups. It is interesting to note that factor 1 scores showed the lowest multiple correlation of all the dependent variables (R^2=.163, $p < .0001$) with the exception of the two item factor 5 scale.

Significant effects for factor 2 scores (academic performance) were obtained for group, sex, age, and the interaction of group and sex. Pst hoc comparisons of means revealed that the group effect consisted of the SLD group having a significantly higher factor 2 mean score than the non-SLD group. Girls had a significantly higher mean score than boys. Eleven and 12 year olds had significantly lower mean factor 2 scores than most other age groups. The significant group X sex interaction signified that non-SLD girls had lower mean factor 2 scores than non-SLD boys, but that SLD girls had slightly higher scores than SLD boys. Finally, although the overall ethnicity effect was not significant for factor 2 scores (F=1.54, $p > .05$), post hoc comparisons between means revealed that Black and Samoan children had higher means than most other ethnic groups. In addition, Japanese-American children had significantly lower mean scores than most of the 13 other ethnic groups, excluding Chinese- and Korean-American students.

Factor 3 scores reflect the significant effects of group membership, age, and a significant group X ethnicity interaction. SLD certified students received higher perceptual-motor scale scores than non-SLD students. The age effect consisted of three and five year olds having higher mean scores than the other age groups, six year olds having lower mean scores than five year olds and higher scores than 7-13 year olds, and 11 and 12 year olds having significantly lower perceptual-motor scores than three, five, six, seven, and eight year olds. The group X ethnicity interaction was complex with SLD students receiving higher ratings than non-SLD students, but with the magnitude of difference between SLD groups varying between ethnic groups.

Group membership and age had significant effects on verbal expression with SLD students being rated more poorly on verbal expression than non-SLD students and younger children being rated more poorly than older children.

Scores on the anxiety-withdrawal scale (factor 5) which consists of only two items, reflect a significant group X sex interaction. Although not a significant effect in the regression analysis, post hoc analysis revealed that SLD students had higher anxiety-withdrawal scores than non-SLD students. Post hoc analysis also revealed that the significant interaction represented non-SLD girls having lower scores than non-SLD boys, but SLD girls having higher scores than SLD boys. In fact, boys' mean scores on this factor hardly differed at all between the SLD and non-SLD groups (2.70 vs. 2.97, respectively). Hence, the difference in mean scores between groups is due mostly to the girls' differences in group scores.

Group membership was the only significant effect for the cyclicity factor with SLD students being rated as being less regular and rhythmic in their behavior cycles by their teachers than their non-SLD classmates.

Finally, group membership, age, and sex all were significantly related to scores students received on the social relationship factor. Non-SLD, older and female students were rated by their teachers as having better social relationship competence than their SLD, younger, and male classmates.

DISCUSSION

The results of this research indicate that the Windward Rating Scale is a useful instrument in screening elementary school students for specific learning disabilities. The 78 percent accurate classification of students as SLD or non-SLD compares very favorably with rates reported for other screening instruments. Adelman (1982), in a critical review of efforts to identify learning problems at an early age, concludes that the best psychometric and rating scale approaches have produced a 46-66% hit rate of identifying students with future school problems. Lindsay and Wedell (1982), in a review of the early identification of educationally at-risk children, report predictive validities of specific instruments as high as .77. Although the classification analysis performed in this study is not an examination of predictive validity, it does reveal that teacher ratings of students on the WRS does identify 78 percent of those students who are later certified SLD according to state criteria.

This 78 percent hit rate can be improved by using weighted linear combinations of factor or subscale scores and by the judicious selection of a cutoff score based on the obtained weighted scores. In the current sample, we have been able to accurately classify approximately 82 percent of the students using a selected cutoff score. It is clear, however, that in the field, factors other than overall identification efficiency must be considered in evaluating a screening instrument (Finn, 1982; Lindsay and Wedell, 1982; Meehl and Rosen, 1955).

As Lindsay and Wedell (1982) argue, one must also evaluate the rates and kinds of specific identification errors made; i.e., what percentage of students who "pass" the screening "fail" a later evaluation (false negatives) and what percentage of students who "fail" the screening "pass" a later evaluation (false positives). Finn (1982) summarizes arguments that this error evaluation is particularly salient in situations where classificatory decisions have real-life consequences and whenever the costs of the two different kinds of errors are not equal. The evaluation provided by this project schematizes the tradeoffs between false negative, false positive, and overall error probabilities associated with a range of cutoff scores. The premise of the current investigation has been that given a reasonable overall error rate, false negative errors are more costly than false postive errors, at the referral stage, in terms of detrimental effects on students. On the other hand, if one is most concerned with reducing monetary costs of providing diagnostic services, one may wish to reduce false positive referrals at the expense of an increase in false negative error rates. A conservative decision in the former case would be to refer students for further evaluation who earned weighted total scores of, or higher than, for example, 1.90. Choice of such a cutoff may result in higher referral rates for children who are eventually found not to be SLD than if higher cutoff scores were used (Figure 2). Such false positive errors, however, seem to have fewer negative consequences for teachers and learning disabled students than do false negative errors. In the latter case, a cutoff of, for example, 2.7 may be used to reduce false positive errors. Such a decision would reduce the amount of special services resources used to evaluate children, although it would lead to increased probability of false negative errors. Although the results of this evaluation cannot be used to support the selection of a single specific cutoff, the results do enable an informed,

data-based decision about selecting a cutoff score to be made at the policy-making levels in the DOE.

No effort was made in the current project to address the thorny issue of the definition of learning disabilities (Kavale and Nye, 1981; Olson and Mealor, 1981; Hammill, Leigh, McNutt, and Larsen, 1981). Nor was any effort made to examine the validity of diagnostic practices used to certify students eligible for special services, although research indicates that in this process, formal diagnostic criteria or assessment results are given less weight than is usually assumed (Shepard and Smith, 1983; Ysseldyke, Algozzine, Richey, and Graden, 1982). Instead, the certification decisions of DOE personnel were accepted as the criterion.

Data which are pertinent to the definition issue are present, however, in the results of the canonical discriminant analysis. It is interesting to note that in deriving the total weighted scores, the student's rated academic performance is given the heaviest weighting of any of the factors considered. Hence, academic performance as judged by the classroom teacher is a major correlate of whether or not a student is eventually certified SLD. However, in deriving total weighted scores, academic performance is qualified by teacher judgments of students' personal-social conduct. This fact is illustrated for both factor and raw scores by the personal-social ratings being subtracted from the academic performance score in deriving the total score. This mathematical statement reflects the clause in the Hawaii state criteria for learning disabilities (Appendix A) and in most definitions of LD (Kavale and Nye, 1981) excluding those students from being certified LD whose impairments are primarily due to emotional handicap or behavior disorders. That the means of nine of thirteen items comprising the personal social factor did not significantly differ between the SLD and non-SLD groups, a finding also reflected in the nonsignificant group effect found in the multiple regression analysis of factor 1 scores, further testifies to the fact that SLD and non-SLD children are not primarily distinguished by their personal-social conduct. This mathematical evidence provides corroborating data that suggest Windward District diagnostic teams are, indeed, using state criteria in their certification and placement decisions. These results contradict, to some extent, Ysseldyke, et al.'s (1982) proposition that diagnostic teams make little use of formal criteria when making eligibility decisions.

The factor structure of the Windward Rating Scale parallels, in part, the factor structures of many rating scales designed to assess childhood psychopathology. The anxiety-withdrawal, personal-social conduct, and academic performance factors have been found in numerous multivariate analyses of child psychopathology (Achenbach, 1983; Lahey, Stempniak, Robinson, and Tyroler, 1978; Quay, 1979).

Quay (1979) in an integrative review of 37 multivariate statistical studies of deviant child behaviors delineates four recurring patterns of behavior. Two of these patterns are termed conduct disorder and anxiety-withdrawal. These two patterns substantively resemble the personal-social and anxiety-withdrawal factors of the current study. Achenbach (1983) in another review of multivariate studies describes four "broad band" syndromes which recur in the literature, three of which he calls overcontrolled, undercontrolled, and learning problems. These three syndromes resemble the anxiety-withdrawal, personal-social, and academic factors of the present study, respectively. Finally, Lahey, Stempniak, Robinson, and Tyroler (1978) describe four factors obtained in an analysis of teacher ratings which they label conduct problems, learning disabilities, anxiety-withdrawal, and hyperactivity. The parallels between their first three factors and three of the seven in the current

study are evident.

The validity of the factor structure of the WRS is supported by the consistent findings of similar factors throughout the literature on multivariate analyses of child psychopathology. In addition to cross-study generality, the cross-cultural generality of these factors has also been posited in a study of Hawaiian-American adolescents by Gordon and Gallimore (1972). This cross-cultural generality is strongly supported by the current study which involved students from 14 different ethnic groups.

Although special services eligibility is a major correlate of WRS scores, regression analyses of total weighted scores and individual factor scores indicate that other factors are significantly associated with teachers' perceptions of students. These factors include sex, age, and ethnicity.

As in most other studies of the prevalence of child psychopathology, boys outnumber girls in the disordered group. As is also commonly found, teacher ratings of personal-social conduct problems were higher for boys than for girls (Achenbach and Edelbrock, 1981; Robins, 1979). Girls were rated by teachers as more noticeably having academic problems than boys, particularly in the SLD group. This fact may be a function of teachers attending primarily to academic behavior in girls, while attending primarily to personal-social conduct in boys. Dweck, Davidson, Nelson, and Enna (1978) observed that teachers' negative feedback for girls was very specifically addressed to intellectual inadequacies on their academic work. Criticism was used almost exclusively for this purpose for girls. In addition, failure for girls seemed to be attributed to lack of ability rather than to lack of motivation. On the other hand, teachers gave negative feedback to boys based more often on their conduct and on nonintellectual aspects of their work. Teachers attributed boys' failures to lack of motivation more often than to lack of ability. Dweck, et al. (1978) argue that their observations account, to a large degree, for the increased incidence of "learned helplessness" in girls. In the current study, girls in the SLD group were rated as manifesting significantly more noticeable anxious-withdrawn behavior than non-SLD girls; whereas, boys in the two groups did not differ on this factor. Such results may be interpreted as indicating that SLD girls may be more depressed than SLD boys. One may speculate that if girls are judged by others and by themselves to a greater degree based on their academic performance than are boys, poor academic performance will affect girls' self-concepts and others' concepts of them to a greater extent than will be the case for boys. Hence, as Dweck and Wortman (1982) argue, girls who perform poorly academically will be more prone to experience depression than will boys.

The age effects on WRS scores can be accounted for primarily by older children (11 and 12 year olds) having lower scores than younger children. This finding may be interpreted to indicate that in older children, the academic and perceptual-motor deficiencies associated with learning disabilities are either less evident or less noticed by teachers. If the deficits become less evident with age and it can be assumed that most fifth and sixth grade SLD students have received special education for some time, it may be argued that special education does work to remediate LD problems and that a child does learn to compensate for his or her weaknesses over time. It may also be argued that developmental maturation naturally results in the alleviation of the deficits associated with LD, an effect that would have been obtained even without special intervention. Unfortunately, the cross-sectional design of this project cannot address

itself to this issue, which is more appropriately approached via a longitudinal design employing controlled, comparison groups.

One other facet of the significant age effect is manifested in five and six year olds earning significantly higher personal-social scores than older children. We believe that this finding reflects a lack of social maturity in younger children. As children acquire experience in school and as they mature emotionally, their behavior becomes more appropriate for that setting.

Ethnicity was not a significant effect in any of the analyses of the factors comprising the WRS, with the exception of its part in a complex interaction with group on the academic and perceptual-motor factors. However, these interactions, particularly the one involving academic performance, is a potentially important finding. Blacks and Samoans earned higher scores than other groups (i.e., teachers perceive them as performing poorly in academic areas). This finding is of some concern in light of reported disproportionate minority representation in special education (Argulewicz, 1983; Tucker, 1980). If the elevated ratings for Blacks and Samoans are based on cultural differences rather than on an actual increased incidence of learning disabilities, teachers may have to adjust their own internal norms to take the cultural differences into account when rating Black and Samoan students. It appears that the raters have been able to adjust their norms for Hawaiians, part-Hawaiians, and other ethnic minorities as these groups did not differ significantly from the other ethnicities in the regression analysis.

In summary, we conclude that the WRS can be a valuable tool to guide teacher referrals of students suspected of having SLD. With the choice of an appropriate cutoff, including a cutoff which reasonably minimizes false negative errors, concurrent diagnostic efficiency using this scale is better than 90 percent. Interrater agreement is adequate, and its factor structure testifies to the scales's construct validity. This evaluation project has raised questions of the effects of student age on teacher ratings, the emotional effects of being certified SLD on girls, and why these effects seem to differ for boys and girls. Finally, further research is needed to examine why Black and Samoan students earn higher ratings on the WRS than students from other ethnic groups. Although these issues and questions have not been addressed in this study, we believe that the results of this evaluation provide a sufficient basis for using a refined WRS as a screening tool to aid teachers and other school personnel in making decisions about referring students for learning disability evaluations.

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Appendix A

In order to be certified as having a specific learning disability by the Hawaii Department of Education, children suspected of of having specific learning disabilities must meet the following three criteria.

Eligibility Criterion No. 1

The child must exhibit a severe discrepancy between the actual and potential achievement levels which is not primarily due to visual, hearing, or motor handicaps, mental retardation, emotional handicap or environmental, cultural, or economic disadvantage.

Eligibility Criterion No. 2

The child must demonstrate a severe discrepancy between actual achievement and potential achievement levels.

The following should be considered in estimating the child's potential achievement level:

1. Academic Performance
2. Psychological Test Scores
3. Speech/Language Evaluation
4. School Social Worker Report
5. Regular Classroom Teacher Report
6. All other available information

The following areas should be evaluated to determine the actual achievement level of the child:

1. Oral Expression
2. Listening Comprehension
3. Written Expression
4. Basic Reading Skills
5. Reading Comprehension
6. Mathematics Calculations
7. Mathematics Reasoning

A severe discrepancy is operationally defined to mean a gap of a given number of years or fractions thereof, the specific number of years depending on the chronological age of the child.

Eligibility Criterion No. 3

The child must exhibit one or more deficits in all of the following three major areas (attention, perceptual/motor, and language) diagnosed through an age-appropriate test or professional observation.

Attention

1. Hyperactive
2. Hypoactive
3. Short attention span
4. Distractible
5. Perseveration
6. Impulsive

Perceptual/Motor

1. Visual
   a. Visual form constancy
   b. Visual position in space
   c. Visual figure ground
   d. Visual memory
2. Auditory
   a. Auditory figure ground
   b. Auditory discrimination
   c. Auditory-vocal association
   d. Auditory memory
   e. Auditory sequencing
3. Motor
   a. Auditory motor integration
   b. Visual motor integration
   c. Fine motor coordination
   d. Laterality

Language

1. Receptive processes
2. Integrative processes
3. Expressive processes

Each of the characteristics, abilities, and processes specified in criterion 3 is defined.

SPECIAL SERVICES
WINDWARD DISTRICT

RATING SCALE
(Personal, Social, Behavioral, Perceptual, Motor, Orientation, and Academic)

Name of Child_____ B.D._____ Age_____ Grade_____

Teacher_____ School_____ Date _____

Please rate each statement by putting an X in the appropriate square after the statement. The squares from 1 to 4 represent the degree to which you have noticed the described behavior.

(1) You have not noticed this behavior at all.
(2) You have noticed the behavior to a slight degree.
(3) You have noticed the behavior to a considerable degree.
(4) You have noticed the behavior to an uncomfortable degree.

I. PERSONAL/SOCIAL/BEHAVIORAL CHARACTERISTICS

	(1)	(2)	(3)	(4)
1. Low tolerance for frustration				
2. Socially bold and aggressive				
3. Overexcitable in normal play with other children				
4. Overly gullible and easily led by peers and older youngsters				
5. Hyperactive and restless				
6. Behavior goes in cycles				
7. Daydreaming alternating with hyperactivity				
8. Erratic, flighty, or scattered behavior				
9. Lacks a variety of responses, repeats himself in many situations				
10. Easily distracted, lacks continuity of effort and perseverance				
11. Negative and aggressive to authority				
12. Behavior often inappropriate for situation and consequences apparently not foreseen				
13. Impulsive, reckless, and uninhibited—tends to be destructive				
14. Impaired concentration ability, attention frequently wanders				
15. Impaired ability to make decisions, particularly from many choices				
16. Upset by changes in routine				
17. Tires easily				
18. Frequently demands attention, speaks out of turn				
19. Withdraws from group activities, prefers to be alone				
20. Tells bizarre stories, comments in class discussion do not pertain to subject being discussed				
21. Explosive and unpredictable behavior				
22. Often more confused by punishment				

	(1)	(2)	(3)	(4)
23. Confused in following directions				
24. Many evidences of stubborn uncooperative behavior				
25. Cannot seem to control self (will speak out or jump out of seat, etc.)				
26. Shallow feeling for others				
27. Confused and apprehensive about rightness of response; indecisive				
28. Difficulty reasoning things out logically with others				
29. Seems generally unhappy				

II. PERCEPTUAL/MOTOR/ORIENTATION

	(1)	(2)	(3)	(4)
1. Impaired discrimination of size				
2. Impaired discrimination of right-left, up-down				
3. Impaired tactile discriminations				
4. Always late or confused				
5. Distorted concept of body image				
6. General clumsiness or awkwardness				
7. Poor gross motor coordination				
8. Poor fine motor coordination				
9. Physically immature				
10. Mild speech irregularities				
11. Poor short term memory				
12. Poor long term memory				
13. Impaired discrimination of auditory stimuli				

III. ACADEMIC

	(1)	(2)	(3)	(4)
1. Reading is poor				
2. Inclined to become confused in number processes; gives illogical responses (Math - poor)				
3. Confusion in spelling and writing (jumbled)				
4. Poor printing, writing, or drawing ability				
5. Variability in performance from day to day or even hour to hour				
6. Slowness in finishing work				
7. Frequent confusion about instructions, yet success with verbal tasks				
8. Uses immature, poor vocabulary, primarily simple nouns, few descriptive words, incomplete sentences with grammatical errors				

	(1)	(2)	(3)	(4)
9. Fails to grasp simple word meanings, misunderstands words				
10. Unable to tell a comprehensible story (difficulty in relating ideas in a logical sequence)				
11. Gropes for words to express himself				
12. Poor ability to organize work				

Language Arts Level _____

Math Level _____

Comments: